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A longitudinal study of depression, PTSD, and anxiety symptoms in first responders

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A longitudinal study of depression, PTSD, and anxiety symptoms in first responders

by

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Abstract

A prospective, longitudinal study of psychopathology in first responders

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First responders witness traumatic events at rates unmatched by nearly any other profession, and research has subsequently found that they exhibit elevated rates of psychopathology. Factors predicting the development of this psychopathology, however, remain largely unknown. This study longitudinally examines predictors of PTSD, depression, and anxiety symptoms in first responders. Participants included 135 emergency medical technicians and paramedics. Multiple linear regressions were used to model predictors of PTSD, depression, and anxiety symptomatology at baseline, as well as changes from baseline to 3-month follow-up. Baseline levels of social support, sleep, emotional stability, and perceived stress were examined as potential predictors. Results revealed that at baseline a) higher depression symptoms were predicted by a model that included greater sleep dysfunction, lower social support, and higher perceived stress; b) PTSD symptoms were also predicted by a model that included greater sleep dysfunction, lower social support, and higher perceived stress; and c) anxiety symptoms were predicted by a model that included greater sleep dysfunction, lower social support, higher

perceived stress, as well as lower emotional stability. At 3-month follow-up a) increases in depression symptoms, b) increases in anxiety symptoms, and c) increases in PTSD symptoms were each predicted by worse sleep and lower social support at baseline. In particular, the sleep subscale of disturbed sleep and the social support subscale of appraisal appeared to be driving these effects. These results highlight the importance of social support and sleep hygiene in protecting against increases in psychopathology symptoms in first responders. Although these factors have established relationships to psychopathology in the general population, their potential to serve as risk or protective factors in first responders has been largely unexplored. Future studies should examine whether interventions targeting sleep disturbances and encouraging deeper social connections can be utilized to protect against symptoms of distress in first responders.

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Chapter 1: Introduction

Emergency first responders are exposed to highly stressful and often traumatic events at frequencies far beyond that of almost any other occupation (Haugen, Evces, & Weiss, 2012). The nature of the job involves processing rapid influxes of critical information while making life and death decisions, often under extreme time pressure. Perhaps unsurprisingly, therefore, research on firefighters, police officers, and emergency medical technicians (EMTs) has consistently found them to exhibit elevated rates of stress-linked psychopathology and symptomology (Morganstein et al., 2016; Gayton & Lowell, 2012; Beaton, 2006; Alexander & Klein, 2001). For example, while in the general population the 12-month prevalence rate of PTSD is 2.5% and of depression 7%, point prevalence rates of PTSD in first responders range from 8-32%, and point prevalence rates of depression range from 16-26% (Kessler et al, 2003; Kessler, Chin, Demler, Merikangas, & Walters, 2005; Kleim & Westphal, 2011). Sleep disturbances have been reported at point prevalence rates as high as 72% for first responders (Courtney, Francis, Paxton, 2010; Sterud, Ekeberg, & Hem, 2006). In ambulance personnel specifically, a recent meta-analysis estimated prevalence rates of 11% for PTSD, 15% for depression, and 15% for anxiety (Petrie et al., 2018). Additionally, this analysis found that 27% of ambulance personnel qualified as having a general mental health disorder.

Despite these alarmingly elevated rates of psychopathology, this population remains critically understudied. Furthermore, these prevalence rates nevertheless imply that at any given time, the majority of first responders are exposed to the continual

traumatic incidents characteristic of this job and yet *are not* experiencing symptoms of psychopathology. This raises the question of what factors allow some first responders to exhibit resilience, while others develop symptoms of debilitating distress. By understanding the factors that both protect from and contribute to the development of psychopathology, the field can work to develop effective training and prevention programs for first responders.

Risk factors in first responders

Although some research has attempted to examine questions of risk and resilience in first responders, the literature is extremely limited, particularly for paramedics and emergency medical service (EMS) workers (Hegg-Deloye et al., 2014). Furthermore, most of the research that has been conducted is cross-sectional, making it difficult to disentangle the influence of psychopathology on risk factors, and vice-versa (Wild, Smith, Thompson, Bear, Lommen, & Ehlers, 2016).

The longitudinal, prospective research that does exist for first responders suggests that low social support, low resilience, neuroticism, catastrophic appraisal style, perceived work stress, previous trauma, and prior psychiatric histories are associated with risk for the development of PTSD and depression in police and firefighters. (Wang et al., 2010; Bryant & Guthrie, 2005; Pietrzak et al., 2014). Echoing these findings, one of the very few studies specifically examining paramedics in a prospective design, found that previous trauma, psychiatric histories, rumination, avoidant coping, neuroticism, low social support, and low resilience were risk factors for developing PTSD or depression (Wild et al., 2016). These studies provide important preliminary evidence and point to the

plausibility of examining these and other risk factors in future studies on psychopathology in EMS workers.

Social support, stress, personality traits, and sleep

Although there are limited data on prospective predictors of psychopathology in first responders, broader theoretical perspectives on PTSD, depression, and anxiety suggest several factors that may be important in predicting risk and resilience in this population. For example, social support has long been shown to act as a powerful buffer against the negative effects of stress (Cohen & Wills, 1985). Chronically stressed individuals with high levels of social support report fewer symptoms of depression and anxiety compared to their low social support counterparts (Cohen, 2004; Cohen & Wills, 1985). Additionally, two meta-analyses have shown that higher levels of social support are negatively correlated with PTSD (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003). The effects of social support also appear to be long-lasting. Dalgard, Bjork, and Tambs (1995) found that higher levels of social support at baseline served as a buffer against negative life events 10 years later.

Personality traits have also been linked to mood and anxiety disorders. Recent research has focused on the connection between the "Big Five" model of personality, and clinical disorders (Kotov, Gamez, Schmidt & Watson, 2010). This model emphasizes five broad factors of personality: extraversion, agreeableness, conscientiousness, neuroticism/emotional stability, and openness to experience (John & Srivastava, 1999). Personality theorists have posited that neuroticism, in particular, is linked to depression, generalized anxiety disorder, and PTSD (Watson, Kotov, & Gamez, 2006). Consistent

with this, a recent meta-analysis on personality and psychopathology found that across 175 studies, participants with diagnoses of depression, PTSD, and anxiety disorders were high on neuroticism and low on conscientiousness (Kotov et al., 2010).

Poor sleep hygiene has also been consistently linked to symptoms of psychopathology. Epidemiological studies estimate that insomnia is comorbid with other psychiatric illnesses in 50-75% of cases (Benca, Obermeyer, Thisted, & Gillin, 1992; Ford & Kamerow, 1989; Eidelman, Gershon, McGlinchey, & Harvey, 2012), with a particularly strong association to mood and anxiety disorders. Current theories suggest that the association between sleep disturbances and psychiatric symptoms is bidirectional, and that this bidirectionality can create a particularly vicious cycle (Harvey, Hairston, Gruber, & Gershon, 2008; Eidelman et al., 2012).

The association between stress and psychopathology is also well established (Kessler, 1997; Dohrenwend, 1998; Tennant, 2002). In particular, much of the research on stress has focused on the importance of *appraised* or *perceived* stress (Lazarus, DeLongis, Folkman, & Gruen, 1985). Specifically, this view emphasizes that when an individual perceives that the demands of a situation exceed the available resources, and that a response is necessary, the situation is appraised as stressful (Cohen, 1986; Lazarus, 1966). A study of nurses and ambulance personnel found that whereas there was no association between objective, critical incidents and PTSD, the individual's *subjective* response predicted the development of PTSD symptoms (Declercq, Meanch, Deheegher, & Van Hoorde, 2011).

The current study

Although the literature on risk factors for mood and anxiety disorders in the general population provides guidance, EMS workers are a unique group. The traumatic stressors they experience on a regular basis set them apart from the general population, and call for empirically based interventions targeting the specific challenges this population faces. The first step in developing such interventions is gaining a deeper understanding of the factors that put first responders at risk for developing debilitating symptoms of distress. Therefore, we designed the current study to examine connections between risk factors and changes in PTSD, depression, and anxiety symptomatology in EMS workers, using a prospective, longitudinal design.

Chapter 2: Method

Participants

Participants (n=135) were recruited via convenience sampling from a large emergency medical service. The sole inclusion criterion for this study was current employment by the city EMS department. The final sample was predominantly Caucasian (90%) and male (78%) with a mean age of 35.63 (Sd=8.24). 42% of the sample attended some college with no degree, 28% earned an associate's degree, 25% earned a bachelor's degree, and 5% attended some graduate school or earned a graduate degree. 15.7% of the sample had been in the job for less than 1 year, 17.2% for 1-3 years, 7.8% for 4-5 years, 25.5% for 6-10 years, 26.0% for 11-15 years, 5.9% for 16-20 years, and 2% for more than 20 years.

Procedure

To recruit participants, researchers presented study information at seven mandatory staff continuing education (CE) meetings. Potential participants were informed of the opportunity to participate in a study examining health behaviors, stress, and mental health in first responders. To reduce the likelihood that participants felt pressure to participate from their superiors, an EMS supervisor and/or researchers in each session made an announcement clearly stating that study participation was optional, and that participation and data collected from this study would not be connected to or recorded in the participant's EMS employment record.

Following the oral presentation and a question and answer session, researchers obtained informed consent from interested participants. Participants completed in-person

measures at Time 1 and on-line measures via Qualtrics three months later. This research protocol was approved by the University of Texas at Austin Human Subjects Review Board.

Measures

Social Support. Social support was measured using the 12-item Interpersonal Support Evaluation List (ISEL; Cohen & Hoberman, 1983). This measure has individuals respond to statements about the perceived quality of their social relationships and supportive resources using a 4-point Likert scale. The ISEL has a three-factor structure measuring availability of someone to confide in about one's problems (appraisal subscale), someone to do activities with (belonging subscale), and someone who can provide material aid (tangible subscale). The scale shows high internal reliability (Cronbach's =.86).

Sleep. Sleep quality and disturbance were measured using the Pittsburgh Sleep Quality Index (PSQI), a 19-item self-report measure that asks participants about seven constructs: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction (Buysse, Reynolds, Monk, Berman & Kupfer, 1988). The sum of the components yields a global sleep assessment score. The scale shows internal reliability (Cronbach's =.83) and high test retest reliability.

Personality. Personality was assessed using the Ten Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann Jr., 2003). This brief measure asks participants to use a 7-point Likert scale to rate how strongly they identify with 10 descriptors. The TIPI

has a 5-factor structure mapping on to the big five personality domains of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experiences. It shows adequate convergent and discriminant validity, and adequate test-retest reliability (Gosling et al., 2003).

Stress. The Perceived Stress Scale (PSS) was used to measure overall subjective stress. The PSS (Cohen, Kamarck, and Mermelstein, 1983) is a 10-item measure assessing the degree to which recent life events have been appraised as stressful. It is a measure of nonspecific appraised stress and has been used in assessing the etiology of depression and anxiety symptoms (Cohen et al., 1983).

Posttraumatic Stress Disorder (PTSD). Symptoms of PTSD were assessed using the Civilian PTSD Checklist (PCL-C) (Weathers, Litz, Herman, Huska, & Kean, 1993). This 17-item checklist corresponds to DSM-IV symptoms of PTSD and consists of three clusters: re-experiencing, avoidance, and hyperarousal. Using a 5-point Lickert scale, participants rate how strongly they have been bothered by each symptom over the past month. The PCL-C demonstrates high internal consistency (Cronbach's =.94).

Depression. Symptoms of depression were assessed using the 10-item Center for Epidemiological Studies Depression Scale (CES-D; Kohout et al., 1993; Andressen, Malmgren, Carter, & Patrick, 1994). The CES-D has individuals rate the frequency of depressive symptoms over the past week on a Likert scale from 0 (rarely/none of the time) to 3 (most or all of the time). It includes five items on somatic symptoms, three on depressed affect, and two on positive affect. The CES-D shows internal reliability (Cronbach's =.86) and high test-retest reliability.

Anxiety. Symptoms of anxiety were measured using the Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988). This 21-item inventory asks participants to rate the frequency with which they've experience common symptoms of anxiety over the past month. Ratings are made from 0 (not at all) to 3 (severely-it bothered me a lot). The BAI has shown strong internal consistency (Cronbach's =.75) and 1-week test-retest reliability (r=.75).

Data Analysis Plan

First, zero order correlations were calculated between all variables of interest. Second, ordinary least squares (OLS) multiple linear regression was used to model variance in a) anxiety, b) depression, and c) PTSD symptoms at baseline. OLS multiple linear regression was next used to model changes in a) anxiety, b) depression, and c) PTSD symptomatology from baseline to 3-month follow-up. In this set of analyses, baseline levels of social support, sleep, emotional stability, and perceived stress were entered into the model as predictors and baseline symptoms levels were used as control variables. Finally, to examine whether specific components of sleep and social support were driving the results, OLS multiple linear regressions were conducted with the subscales of each measure as predictors.

For every set of regression analyses, the choice of final models was guided by the Akaike Information Criterion (AIC) (Bozdogan, 1987). The AIC, as opposed to adjusted R^2, was used as the decision point as it provides a stricter cutoff for predictor inclusion, thus reducing Type I error likelihood. See Appendix A for all models considered. Regression diagnostics revealed that the assumptions of linear regression models were

met, except that in roughly half of cases, residuals were not normally distributed. This finding is not unexpected, given the inherently skewed nature of the outcome variables. To address this, we repeated the regression analyses using non-parametric bootstrapping, as a validation check. In all cases, bootstrapping confirmed the results of ordinary least squares regression.

Chapter 3: Results

Data were checked for abnormal values, outliers, and expected ranges. The only outliers removed were for data entry errors (i.e. impossible values). To test for the possibility that significant differences exist between those who completed the follow-ups and those who did not, we conducted independent samples t-tests to compare these two groups at baseline, and found no significant between-group differences. (See Appendix B for output). All data analyses were conducted in R.

Descriptive statistics and zero order correlations are in Table 1. At baseline, 58.5% of participants had scores of 10 or higher on the CESD, suggesting probable clinical depression. At 3-month follow-up, 67.4% had scores of 10 or more. On the PCL-C, 11.9% had scores of 44 or greater at baseline, suggesting probable PTSD. At 3-month follow-up 14.8% had scores of 44 or more. On the BAI at baseline, 63.7% had scores of 0-7, 27.4% had scores of 8-15, 7.4% had scores of 16-25, and 1.5% had scores of 26 or greater, suggestive of minimal, mild, moderate, and severe anxiety, respectively. At 3-month follow-up, 64.4% of participants had BAI scores suggestive of minimal anxiety, 23.0% suggestive of mild anxiety, 6.67% suggestive of moderate anxiety, and 5.9% suggestive of severe anxiety.

Baseline association models

Depression. Using the model selection criteria described above, depression symptoms at baseline were best accounted for by a model that included sleep dysfunction, perceived stress, and social support. The overall model with all three variables accounted for 45% of variance in depression ($F(3,99) = 27.06$, $p < 0.001$). For

individual predictors within the model, poorer sleep quality and higher perceived stress were each significantly associated with higher levels of depression.

PTSD. PTSD symptoms at baseline were best accounted for by a model that included sleep hygiene, perceived stress, and social support. The overall model accounted for 60.9% of the variance in PTSD symptoms ($F(3,99) = 51.34$, $p < 0.001$). For individual predictors, poorer sleep, higher perceived stress, and lower social support each significantly predicted greater PTSD symptoms.

Anxiety. Anxiety symptoms at baseline were best accounted for by a model that included sleep dysfunction, perceived stress, social support, and emotional stability. The overall model with all four variables accounted for 46.6% of variance in anxiety ($F(3,98) = 21.36$, $p < 0.001$). For individual predictors within the model, worse sleep hygiene, greater perceived stress, and lower emotional stability each accounted for increased anxiety scores. See Table 2 for summary of depression, PTSD, and anxiety regression models.

Predictors of changes in symptomatology from baseline to 3-month follow-up

Depression. Using the model selection criteria described above, change in depression symptoms from baseline to 3-month follow-up was best predicted by a model that included sleep quality and social support as predictors, and baseline levels of depression as a control variable. The overall model accounted for 40.4% of the variance in depression symptoms ($F(3,99) = 22.39$, $p < 0.001$). For individual predictors within the model, poorer sleep quality and lower social support at baseline were significantly associated with increases in depression symptoms 3 months later.

Anxiety. Change in anxiety symptoms from baseline to 3-month follow-up was predicted by sleep quality and social support with baseline levels of anxiety as a control variable. The overall model accounted for 58.65% of the variance in anxiety symptoms ($F(3,99) = 46.81$, $p < 0.001$). For individual predictors within the model, poorer sleep quality and lower social support at baseline were each associated with increases in anxiety symptoms 3 months later.

PTSD. Change in PTSD symptoms from baseline to 3-month follow-up was predicted by sleep dysfunction, and social support with baseline levels of PTSD as a control variable. The overall model accounted for 62.83% of the variance in PTSD symptoms ($F(3,99) = 55.79$, $p < 0.001$). In terms of individual predictors, poorer sleep quality and lower social support at baseline were each associated with increases in PTSD symptoms 3 months later. See Table 3 for summary of depression, PTSD, and anxiety regression models.

In summary, we found that at baseline: 1) depression symptoms were best predicted by a model that included sleep dysfunction, social support, and perceived stress; 2) PTSD symptoms were also best predicted by a model that included sleep dysfunction, social support, and perceived stress; and 3) anxiety symptoms were best predicted by a model that included sleep dysfunction, social support, perceived stress, as well as emotional stability. At 3-month follow-up, we found that increases in all three outcomes (depression, anxiety, and PTSD symptomatology) were predicted by baseline sleep and social support. We next examined the unique contribution of subscales within each of these two predictors.

Subscale Analyses

Sleep Subscales. To examine the relative contribution of the seven validated PSQI subscales on changes in depression symptoms, the seven subscales were entered into a multiple linear regression model which included baseline social support and baseline depression symptoms as control variables. Higher scores on the sleep disturbance subscale at baseline significantly predicted increases in depression symptoms 3 months later. No other subscales accounted for significant variance in depression. For PTSD symptoms at 3-month follow-up, the 7 subscales were entered into a model that included baseline social support and baseline PTSD symptoms as covariates. As with changes in depression symptoms, only sleep disturbance predicted increases in PTSD. Finally, for anxiety symptoms at 3-month follow-up, all 7 subscales were entered into a model that included baseline social support and baseline anxiety symptoms. Greater sleep disturbance and increased medication use predicted increases in anxiety symptoms. See Table 4 for summary of regression results.

Social Support Subscales. To examine the relative contribution of the three validated social support subscales on changes in depression symptoms, the three subscales were entered into a multiple linear regression model which included baseline sleep dysfunction and baseline depression symptoms as control variables. Lower scores on the appraisal subscale were marginally significant in accounting for increases in depression symptoms, and no other subscales explained variance in depression. For PTSD symptoms at 3-month follow-up, the social support subscales were entered into a model that included baseline sleep and baseline PTSD symptoms, and lower appraisal

was significantly associated with increases in PTSD symptoms. No other subscales explained variance in PTSD. Finally, for anxiety symptoms at 3-month follow-up, the social support subscales were entered into a model that included baseline sleep and baseline anxiety symptoms as covariates, and lower appraisal marginally significantly accounted for increases in anxiety. No other subscales explained variance in anxiety. See Table 5 for summary of regression results.

In summary, we found that the subscale of sleep disturbance, was significantly driving the effect of sleep on symptoms of depression, anxiety and PTSD. Medication usage appeared to also contribute to the effect of sleep on anxiety symptoms. In terms of social support, the appraisal subscale was significantly driving the effect on PTSD and marginally significant for anxiety and depression symptoms. No other social support subscales appear to be driving these effects.

Chapter 4: Discussion

The objective of this study was to examine the potential role of individual, person-specific factors in a longitudinal model of psychopathology risk in EMS responders. Our primary finding was that low levels of social support and poor sleep at baseline were associated with increases in PTSD, anxiety, and depression symptoms 3 months later.

Previous research on samples from the general population has consistently found social support, sleep, emotional stability, and perceived stress to each play an important role in psychopathology development (Brewin, Andrews, & Valentine, 2000; Benca, Obermeyer, Thisted, & Gillin, 1992; Kotov et al., 2010; Declercq, Meanch, Deheegher, & Van Hoorde, 2011). Although research on EMS responders is much more limited, preliminary work, particularly cross-sectional research, has similarly suggested that these predictors are also important in this population. For example, a cross-sectional study of paramedics found that those who met criteria for PTSD reported higher perceived stress and lower social support (Fjeldheim et al, 2014). Others have found that PTSD in EMS personnel is cross-sectionally correlated with higher levels of neuroticism and worse sleep (Sheikhbardsiri et al., 2015; Wild et al.,2016). In line with these findings, when we examined these predictors at baseline as zero order correlations, we, too, found that higher perceived stress and lower social support, sleep, and emotional stability were each correlated with greater symptoms of anxiety, depression, and PTSD.

Examining semi-partial correlations at baseline in order to better account for shared variance between variables, however, we found that the best models for explaining

variance were somewhat narrower. Both depression symptoms and PTSD symptoms at baseline were best predicted by models that included social support, sleep, and perceived stress. Anxiety symptoms at baseline was best predicted by a model that included social support, sleep, perceived stress, and emotional stability. The fact that social support, sleep, and perceived stress were included in each of these final models extends previous cross-sectional findings of zero order correlations by showing that even when accounting for the shared variance of these predictors, all three predictors remain correlated with symptoms of psychopathology.

The fact that emotional stability was only included in the model predicting anxiety, and not in models predicting depression or PTSD, is somewhat unexpected given that this trait has been broadly linked to psychopathology. This may be due, in part to the fact that EMS workers in this sample had higher and more homogeneous scores on emotional stability than the general population, thus restricting variability in the predictor. The mean in our sample was 5.33 (SD=1.29), whereas the mean for general adults 21-60 ranges from 4.09 (SD=1.45) to 4.8. (SD=1.38) (Gosling, Rentfrow, & Potter, 2014). Considering the scale maximum score of 7, this skewed range may be contributing to this pattern. High levels of emotional stability are unsurprising in this population given that remaining calm and emotionally stable in a crisis is key in this line of work. Nevertheless, given the novelty of this finding, replication is essential before firm conclusions can be drawn. Future research should examine whether this finding of high levels of emotional stability and lack of predictive power holds in first responders more broadly.

What makes the current dataset unique derives from our ability to examine these predictors prospectively. In doing so, we found that worsening symptoms of PTSD, depression, and anxiety were all significantly predicted by social support and sleep dysfunction, with effect sizes ranging from 0.15-0.22. Thus, higher levels of social support and better sleep hygiene at baseline were protective against increases in symptoms 3 months later. This finding is consistent with literature that shows sleep and social support to be longitudinally predictive of psychopathology symptoms in the general population (Brewin, Andrews, & Valentine, 2000; Benca, Obermeyer, Thisted, & Gillin, 1992) and extends these finding to paramedics and EMTs.

In contrast to sleep and social support, perceived stress and emotional stability at baseline were not included in the final prospective models and did not significantly predict changes in depression, anxiety, or PTSD longitudinally. This finding is important, first, from a methodological perspective. It emphasizes the importance of longitudinal approaches to studying psychopathology as factors that may appear significant cross-sectionally, may not actually be predictive of future symptoms.

For example, although we found perceived stress to be consistently correlated with symptoms of psychopathology at baseline, it was not a significant predictor prospectively. When looking prospectively and accounting for shared variance among predictors, social support and sleep better predict symptoms of anxiety, depression, and PTSD than does perceived stress. This suggests that perceived stress is perhaps a better *reflection* of current psychopathology than predictor of future psychopathology.

This finding is somewhat surprising given the very large literature on the importance of stress as a *predictor* of psychopathology in the general population (Kessler, 1997). One potential explanation for this is that the PSS may not be the best measure of stress *in this specific population*. Given that the PSS is a general measure of perceptions of stress, and that stressors in this population are unique, perhaps a different measure is needed in order to better capture variations in stress in this population and the way this stress relates to future symptoms of psychopathology.

Sleep and Social Support Subscales

To explore whether specific components of sleep and social support have disproportionate effects on psychopathology, we examined the subscales within each of these measures. Within the sleep measure, *only* the subscale of disturbed sleep was significantly predictive of depression and PTSD symptoms 3 months later. Disturbed sleep and, to a lesser extent, medication use, were the only subscales significantly predictive of anxiety symptoms 3 months later. Disturbed sleep is a measure of how frequently over the past month individuals report having "trouble sleeping" due to a list of reasons ranging from feeling hot to having bad dreams (Buysse, Reynolds, Monk, Berman & Kupfer, 1988). One of the challenges facing first responders is that they often work overnight shifts and have rotating schedules, making it difficult to sleep say, a consistent 8 hours every night. Changing this shift style of work would be extremely difficult within the current structure of emergency response centers, and fortunately these findings suggest that may not be necessary. These findings suggest that it is not the objective number of hours slept or even sleep efficiency that matters most. Rather, it

appears that it is subjectively feeling that you have had trouble sleeping that predicts psychopathology. This finding is clinically relevant in that it suggests that first responders don't necessarily need different schedules or more time to sleep, but instead may benefit from sleep hygiene interventions and tools in order to reduce difficulties falling and staying asleep.

For social support, *only* the appraisal subscale predicted psychopathology symptoms. This subscale measures the extent to which individuals have someone to confide in about their problems. Whereas other subscales measure tangible support or having friends to see a movie with, it appears that it is this deeper emotional connection that is protective against psychopathology. It remains to be seen whether education around the importance of not just social interactions, but deeper emotional relationships could improve symptoms of psychopathology in this population.

Limitations

One major limitation of this study is the variability in job tenure among our participants, which ranges from 3 months to over 20 years. Furthermore, given that most respondents had been on the job for many years, the average change in psychopathology symptoms over the 3 months of study was fairly small, with most of the variance in follow-up psychopathology scores explained by baseline scores of psychopathology. With only small changes in symptoms, our ability to fully assess risk and resilience factors was severely limited. Additionally, we experienced attrition rates of 33% at 3-month follow-up. Although there were no significant differences at baseline between

those who completed follow-ups and those who did not, it is possible that the non-completers represent a distinct population not captured by these data.

Conclusion

The current longitudinal study examined risk for, and resilience to, psychopathology symptoms in a sample of EMS workers. Results suggest that sleep hygiene and social support are key in protecting against increases in symptoms of depression, anxiety, and PTSD. Specifically, subjective sleep disturbances appear to put first responders at risk, and social support in the form of emotional connections and counsel protects them. In light of these findings, future studies should examine whether interventions targeting sleep disturbances and encouraging deeper social connections can be utilized to protect against symptoms of distress.

Despite the fact that elevated rates of psychopathology have been well established in the EMS population, our understanding of individual risk factors remains incomplete, with first responders continuing to suffer from stress-related psychopathology at rates far higher than in the general population. This study contributes important information to our understanding of risk in first responders, but much work remains in order to further explicate the factors that put first responders at risk and how best we can intervene to strengthen resilience in this important population.

Tables

Table 1

Correlation Matrix and Descriptive Information for Primary Variables of Interest

	Mean	SD	1.	2.	3.	4.	5.	6.	**7.**
1. PTSD Symptoms at Baseline	29.67	11.81	1***						
2. Depression Symptoms at Baseline	10.61	3.67	0.71***	1***					
3. Anxiety Symptoms at Baseline	6.92	6.41	0.70***	0.63***	1***				
4. Perceived Stress	15.18	6.88	0.69***	0.56***	0.58***	1***			
5. Sleep Dysfunction	8.52	4.12	0.56***	0.51***	0.47***	0.45***	1***		
6. Social Support	40.26	6.66	-0.48***	-0.38***	-0.33***	-0.50***	-0.30**	1***	
7. Emotional Stability	5.33	1.29	-0.47***	-0.41***	-0.44***	-0.52***	-0.31**	0.47***	1***

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 2

Multiple Linear Regression Output for Depression, PTSD, and Anxiety at Baseline

Outcome	Variable	B	Standard Error	T-value	*p*-value
Depression at Baseline	Sleep Dysfunction	.35	0.09	4.02	<.001 ***
	Perceived Stress	.38	0.10	3.83	<.001 ***
	Social Support	-.14	0.09	-1.53	.129
PTSD at Baseline	Sleep Dysfunction	.30	0.07	4.17	<.001***
	Perceived Stress	.50	0.08	5.92	<.001***
	Social Support	-.21	0.07	-2.64	.010**
Anxiety at Baseline	Sleep Dysfunction	.25	0.08	2.93	.004 **
	Perceived Stress	.45	0.10	4.42	<.001 ***
	Social Support	.05	0.10	0.48	.630
	Emotional Stability	-.22	0.10	-2.17	.032*

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 3

Multiple Linear Regression Output for Depression, PTSD, and Anxiety at 3-month Follow-up

Outcome	Variable	B	Standard Error	T-value	*p*-value
Depression at 3 months	Depression at Baseline	.37	0.10	3.86	<.001***
	Sleep Dysfunction	.20	0.09	2.10	.038*
	Social Support	-.23	0.09	-2.54	.013*
PTSD at 3 months	PTSD at Baseline	.60	0.09	6.97	<.001***
	Sleep Dysfunction	.16	0.08	2.06	.042 *
	Social Support	-.19	0.08	-2.42	.018 *
Anxiety at 3 months	Anxiety at Baseline	.54	0.08	6.98	<.001***
	Sleep Dysfunction	.22	0.08	2.88	.005**
	Social Support	-.20	0.07	-2.73	.007**

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 4

Regression Output for Analysis of Sleep Disturbance Subscales

Outcome	Variable	β	*p*-value	R^2
Depression at 3 months	Depression at BL	.39	<.001***	0.431
	Social Support	-.18	.070.	
	Sleep Disturbance	.19	.032 *	
	Sleep Latency	.02	.876	
	Sleep Duration	.01	.927	
	Habitual Sleep Efficiency	-.07	.486	
	Sleep Quality	.002	.189	
	Medication	.07	.407	
	Days of Dysfunction	.10	.296	
PTSD at 3 months	PTSD at BL	.54	<.001***	0.703
	Social Support	-.15	.055.	
	Sleep Disturbance	.30	<.001 ***	
	Sleep Latency	.08	.280	
	Sleep Duration	-.02	.827	
	Habitual Sleep Efficiency	-.08	.247	
	Sleep Quality	-.03	.685	
	Medication	.03	.619	
	Days of Dysfunction	.10	.188	
Anxiety at 3 months	Anxiety at BL	.51	<.001***	
	Social Support	-.18	.023*	
	Sleep Disturbance	.24	.001**	
	Sleep Latency	.07	.399	
	Sleep Duration	.02	.847	
	Habitual Sleep Efficiency	-.03	.649	
	Sleep Quality	-.06	.482	
	Medication	.14	.048	
	Days of Dysfunction	.07	.439	

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 5

Regression Output for Analysis of Social Support Subscales

Outcome	Variable	β	*p*-value	R^2
Depression at 3 months	Depression at BL	.40	<.001***	0.410
	Sleep Dysfunction	.16	.082	
	Appraisal Social Support	-.20	.051.	
	Belonging Social Support	-.11	.344	
	Tangible Social Support	.05	.679	
PTSD at 3 months	PTSD at BL	.61	<.001 ***	0.629
	Sleep Dysfunction	.13	.094	
	Appraisal Social Support	-.20	.023*	
	Belonging Social Support	-.003	.974	
	Tangible Social Support	-.01	.884	
Anxiety at 3 months	PTSD at BL	.55	<.001***	0.599
	Sleep Dysfunction	.20	.007**	
	Appraisal Social Support	-.15	.073.	
	Belonging Social Support	.06	.490	
	Tangible Social Support	-.15	.137	

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Appendices

Appendix A

Table 6

Models assessed for predicting depression at baseline

	Variables	β	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Sleep Dysfunction	0.34	0.09	3.90	<.001 ***	0.454	246.37
	Perceived Stress	0.36	0.10	3.48	<.001 ***		
	Emotional Stability	-0.08	0.10	-0.77	0.445		
	Social Support	-0.12	0.10	-1.14	0.257		
Model 2	Sleep Dysfunction	0.34	0.09	4.02	<.001 ***	0.451	244.98
	Perceived Stress	0.38	0.10	3.83	<.001 ***		
	Social Support	-0.14	0.09	-1.53	0.129		
Model 3	Sleep Dysfunction	0.33	0.09	3.72	<.001 ***	0.399	256.02
	Perceived Stress	0.44	0.09	4.88	<.001 ***		
Model 4	Perceived Stress	0.56	.072	7.73	<.001 ***	0.310	337.99

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 7

Models assessed for predicting anxiety at baseline

	Variables	β	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Sleep Dysfunction	0.25	0.08	2.93	0.004**	0.754	240.95
	Perceived Stress	0.45	0.10	4.42	<.001***		
	Emotional Stability	-0.21	0.10	-2.17	0.032*		
	Social Support	0.05	0.10	0.48	0.630		
Model 2	Sleep Dysfunction	0.23	0.08	2.73	0.007	0.462	243.91
	Perceived Stress	0.42	0.09	4.46	<.001***		
	Emotional Stability	-0.22	0.09	-2.47	0.015*		
Model 3	Sleep Dysfunction	0.25	0.08	2.94	0.004**	0.430	248.05
	Perceived Stress	0.52	0.09	6.06	<.001***		
Model 4	Sleep Dysfunction	0.48	0.09	5.46	<.001***	0.225	278.32

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 8

Models assessed for predicting PTSD at baseline

	Variables	β	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Sleep Dysfunction	0.30	0.07	4.10	<.001***	0.610	211.01
	Perceived Stress	0.49	0.09	5.60	<.001***		
	Emotional Stability	-0.02	0.09	-0.29	0.772		
	Social Support	-0.20	0.09	-2.33	0.022*		
Model 2	Sleep Dysfunction	0.30	0.07	4.17	<.001***	0.609	209.10
	Perceived Stress	0.50	0.0	5.92	<.001***		
	Social Support	-0.21	0.08	-2.64	0.0097**		
Model 3	Sleep Dysfunction	0.30	0.07	4.13	<.001***	0.567	219.55
	Perceived Stress	0.59	0.08	7.80	<.001***		
Model 4	Perceived Stress	0.69	0.06	10.92	<.001***	0.473	301.67

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 9

Models assessed for predicting depression at 3-month follow-up

	Variables	β	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Baseline Depression	0.36	0.10	3.43	<.001***	0.405	254.87
	Sleep Dysfunction	0.19	0.10	1.99	0.049*		
	Social Support	-0.22	0.11	-2.04	0.044*		
	Perceived Stress	0.04	0.11	0.35	0.725		
	Emotional Stability	0.001	0.11	0.01	0.992		
Model 2	Baseline Depression	0.37	0.10	3.77	<.001***	0.404	253.0
	Sleep Dysfunction	0.20	0.10	2.07	0.041*		
	Social Support	-0.23	0.10	-2.23	0.028*		
	Emotional Stability	-0.01	0.10	-0.07	0.943		
Model 3	Baseline Depression	0.37	0.10	3.86	<.001***	0.404	251.00
	Sleep Dysfunction	0.20	0.09	2.10	0.038*		
	Social Support	-0.23	0.09	-2.54	0.013*		
Model 4	Baseline Depression	0.52	0.08	6.95	<.001***	0.374	323.73
	Social Support	-0.18	0.08	-2.41	0.018*		
Model 5	Baseline Depression	0.59	0.07	8.43	<.001***	0.348	330.36

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 10

Models assessed for predicting anxiety at 3- month follow-up

	Variables	B	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Baseline Anxiety	0.52	0.09	5.85	<.001***	0.593	216.61
	Sleep Dysfunction	0.22	0.08	2.80	0.006**		
	Social Support	-0.17	0.09	-1.90	0.06		
	Perceived Stress	-0.03	0.10	-0.30	0.76		
	Emotional Stability	-0.11	0.10	-1.23	0.22		
Model 2	Baseline Anxiety	0.51	0.08	6.30	<.001***	0.593	214.71
	Sleep Dysfunction	0.21	0.08	2.80	0.006**		
	Social Support	-0.16	0.08	-1.91	0.06		
	Emotional Stability	-0.11	0.09	-1.20	0.23		
Model 3	Baseline Anxiety	0.54	0.078	6.98	<.001***	0.587	214.22
	Sleep Dysfunction	0.22	0.08	2.88	0.005**		
	Social Support	-0.20	0.07	-2.73	0.007**		
Model 4	Baseline Anxiety	0.60	0.07	8.03	<.001***	0.559	221.85
	Sleep Dysfunction	0.25	0.08	3.28	0.001**		
Model 5	Baseline Anxiety	0.66	0.07	10.04	<.001***	0.431	311.95

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Table 11

Models assessed for predicting PTSD at 3-month follow-up

	Variables	β	Standard Error	T-value	*p*-value	R^2	AIC
Model 1	Baseline PTSD	0.59	0.10	5.80	<.001***	0.629	213.62
	Sleep Dysfunction	0.16	0.08	1.99	0.049*		
	Social Support	-0.18	0.09	-2.05	0.043*		
	Perceived Stress	0.02	0.10	0.21	0.833		
	Emotional Stability	-0.01	0.09	-0.14	0.892		
Model 2	Baseline PTSD	0.59	0.10	5.83	<.001***	0.629	211.64
	Sleep Dysfunction	0.16	0.08	2.02	0.046*		
	Social Support	-0.19	0.08	-2.25	0.027*		
	Perceived Stress	0.02	0.10	0.25	0.804		
Model 3	Baseline PTSD	0.60	0.09	6.97	<.001***	0.628	209.70
	Sleep Dysfunction	0.16	0.08	2.06	0.042*		
	Social Support	-0.19	0.08	-2.42	0.018*		
Model 4	Baseline PTSD	0.70	0.06	11.01	<.001***	0.651	265.69
	Social Support	-0.13	0.06	-2.03	0.044*		
Model 5	Baseline PTSD	0.76	0.06	13.58	<.001***	0.645	270.70

Note. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$.

Appendix B

Table 12

Comparison of baseline scores between participants who did and did not complete follow-up

	Follow-up group			Attrition Group			*t*	*p*
	M	*SD*	*n*	*M*	*SD*	*n*		
Baseline Depression	10.61	3.67	135	10.3	3.25	69	-0.86	0.392
Baseline Anxiety	6.92	6.41	135	6.5	6.43	69	-0.45	0.650
Baseline PTSD	29.67	11.81	135	28.29	10.3	68	-0.59	0.553

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